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Preface

Special issue on structural operational semantics

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This special volume of Information and Computation aims at documenting state-of-the-art research, new developments, and directions for future investigation in the field of structural operational semantics (SOS). It includes papers about the SOS of concurrent processes, addressing ordered SOS, simulation up-to, mobility, name-passing, and congruence formats. It also contains papers about the SOS of programming languages, focussing on bialgebraic semantics, co-inductive and bi-inductive forms of big-step SOS, the relationship to rewriting logic semantics, and the use of logical relations.

Since its introduction by Robin Milner [1] and Gordon Plotkin [2] around 1980, SOS has become one of the main semantic description frameworks. It has been used to describe the static and dynamic semantics of numerous programming and concurrent process languages, and some non-executable specification languages. Its most characteristic feature is the use of axioms and inference rules to define transition relations, which are usually structural in the sense that transitions for compound phrases are inferred from transitions for their sub-phrases.

SOS has considerable intuitive appeal and flexibility, and is based on simple and familiar mathematical foundations. At the same time, it is remarkably powerful. For instance, when a concurrent process language is defined by an SOS whose rules are in a restricted format, various useful properties of the language, such as compositionality of its operators with respect to a given semantic equivalence, are ensured.

This volume is an outgrowth of the series of SOS workshops, which started in 2004, and contains full versions of several papers presented at SOS 2004, 2006 and 2007. (Other papers presented at SOS 2004 appeared in a special issue of the Journal of Logic and Algebraic Programming [3], and papers from SOS 2005 were published in a special issue of Theoretical Computer Science [4].) However, papers that were not presented at these workshops were equally welcome, and all submissions have been refereed and subjected to the same quality criteria, meeting the standards of Information and Computation. Eleven papers have been selected out of a total of seventeen submissions:

1. *Semantics and expressiveness of ordered SOS*, by MohammadReza Mousavi, Iain C.C. Phillips, Michel A. Reniers and Irek Ulidowski, studies the meaning of general types of ordered SOS rules, and gives semantics-preserving transformations between ordered rules and rules with negative premises.
2. *Generating priority rewrite systems for ordered SOS process languages*, by Irek Ulidowski and Shoji Yuen, gives an algorithm for generating priority rewrite systems from ordered SOS rules such that rewriting is sound for bisimulation and head normalising.
3. *(Bi)Simulations up-to characterise process semantics*, by David de Frutos Escrig and Carlos Gregorio Rodríguez, provides a coinductive, simulation-like characterisation of semantic preorders for processes. The results include the generation of complete axiomatisations, and apply to a wide class of preorders.
4. *Mobility control via passports*, by Samuel Hym, studies Dπ, a simple distributed extension of the π-calculus in which agents are mobile. The paper introduces a notion of passports, whose type system includes a novel use of dependent types, and develops an observational equivalence.

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5. *An observation theory for mobile ad hoc networks*, by Massimo Merro, gives both a reduction semantics and an equivalent SOS of a new calculus of mobile ad hoc networks, and derives a form of bisimilarity that completely characterises reduction barbed congruence.
6. *A congruence rule format for name-passing process calculi*, by Marcelo Fiore and Sam Staton, introduces a GSOS-like rule format for name-passing process calculi. Specifications in this format correspond to theories in nominal logic, and a variant of open bisimilarity is a congruence.
7. *Bialgebraic methods and modal logic in SOS*, by Bartek Klin, combines bialgebraic semantics with a coalgebraic approach to modal logic in a novel, general approach to proving the compositionality of process equivalences and defining congruence formats.
8. *Bi-inductive structural semantics*, by Patrick Cousot and Radhia Cousot, proposes a simple order-theoretic generalisation of set-theoretic inductive definitions, which allows SOS to describe simultaneously the finite and infinite behaviours of programs.
9. *Coinductive big-step operational semantics*, by Xavier Leroy and Hervé Grall, illustrates the use of coinductive definitions and proofs in big-step operational semantics, giving proofs of type soundness and of semantic preservation for compilers. All results have been proved using the Coq proof assistant.
10. *A rewriting logic approach to operational semantics*, by Traian Florin Şerbănuţă, Grigore Rosu and José Meseguer, shows how rewriting logic semantics can be used as a computational logic framework for semantic definitions of programming languages in big-step and small-step SOS, modular SOS, reduction semantics, continuation-based semantics, and the chemical abstract machine.
11. *A family of syntactic logical relations for the semantics of Haskell-like languages*, by Janis Voigtlaender and Patricia Johann, shows how to bring reasoning via logical relations closer to bear on real programming languages by constructing logical relations that characterise notions of observational equivalence and approximation for an intermediate abstraction of Haskell.

Together, these articles show that SOS is a vigorous research area, and that the range of applications of SOS continues to increase.

We would not have been able to put together this volume without the dedicated help and thorough feedback of many referees, to whom we hereby extend our gratitude.

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